TENNESSEE DEPARTMENT OF EDUCATION
FIRST TO THE TOP

Automation and Robotics (PLTW)

Primary Career Cluster:	Science, Technology, Engineering, and Mathematics (STEM)
Consultant:	Casey Haugner Wrenn, (615) 532-4879, Casey.Haugner@tn.gov
Course Code:	0883
Prerequisite(s):	None
Credit:	N/A
Grade Level:	7
Graduation Requirement:	N/A
Coursework and Sequence:	This is a course in the *Project Lead the Way (PLTW)* middle school sequence of coursework.
Vendor Resources:	Visit www.pltw.org for more information.
Aligned Student Organization(s):	Technology Student Association (TSA):http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit http://tn.gov/education/cte/work_based_learning.shtml.
Available Student Industry Certifications:	N/A
Dual Credit or Dual Enrollment Opportunities:	N/A
Teacher Endorsement(s):	007, 013, 014, 015, 016, 017, 018, (042 and 043), (042 and 044), (042 and 045), (042 and 046), (042 and 047), (042 and 077), (042 and 078), (042 and 079), (043 and 044), (043 and 045), (043 and 046), (043 and 047), (043 and 077), (043 and 078), (043 and 079), (044 and 045), (044 and 046), (044 and 047), (044 and 077), (044 and 078), (044 and 079), (045 and 046), (045 and 047), (045 and 077), (045 and 078), (045 and 079), (046 and 047), (046 and 077), (046 and 078), (046 and 079), (047 and 077), (047 and 078), (047 and 079), (077 and 078), (077 and 079), (078 and 079), 070, 081, 105, 121, 122, 123, 124, 125, 126, 127, 128, 129, 144, 145, 147, 157 210, 211, 212, 213, 214, 230, 231, 232, 233, 407, 413, 414, 415, 416, 417, 418, 440, 460, 461, 470, 477, 480, 481, 482, 483
Required Teacher Certifications/Training:	Teachers who have never taught this course MUST attend the training provided by PLTW and receive certification.
Teacher Resources:	http://www.tn.gov/education/cte/ScienceTechnologyEngineeringMathematics.shtml

Course Description

This is a course in the series of *Project Lead the Way (PLTW)* curriculum. For more information, visit the PLTW website at http://www.pltw.org/.

Program of Study Application

These courses build knowledge and skills related to the following career clusters:

1) Architecture & Construction
2) Information Technology (IT)
3) Manufacturing
4) Science, Technology, Engineering & Mathematics (STEM)
5) Transportation, Distribution, & Logistics

Course Standards

The course standards outlined below are the copyrighted property of *Project Lead the Way*. Teachers must participate in *Project Lead the Way* training in order to be able to teach this course. This course is one in a series of PLTW middle school courses. The lesson numbers below reflect the recommended sequence.

Lesson 2.1 What is Automation and Robotics? (7 days)

Understandings

1) Automation is the use of technology to ease human labor or to extend the mental or physical capabilities of humans.
2) Robotics is the specialized field of engineering and computer science that deals with the design, construction, and application of robots.
3) The use of automation and robotics affects humans in various ways, both positively and negatively, including their safety, comfort, choices, and attitudes about a technology's development and use.
4) Automation and robotics have had an influence on society in the past and present and will influence society in the future.
5) Engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.

Knowledge and Skills

It is expected that students will:

- Describe the purpose of automation and robotics and its effect on society.
- Summarize ways that robots are used in today's world and the impact of their use on society.
- Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- Provide examples of STEM careers and the need for these professionals in our society.

Lesson 2.2 Mechanical Systems (12 days)

Understandings

1) Energy is the capacity to do work; the use of mechanisms is necessary to transfer energy.

2) Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
3) Mechanisms can be used individually, in pairs, or in systems.

Knowledge and Skills
It is expected that students will:

- Use ratios to solve mechanical advantage problems.
- Use numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios.
- Use the characteristics of a specific mechanism to evaluate its purpose and applications.
- Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion.

Lesson 2.3 Automated Systems (26 days)

Understandings

1) Automated systems require minimal human intervention.
2) An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.
3) Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
4) Comments do not change the way a robot behaves, but they do allow the programmer to remember the function that the code performs.
5) Invention is a process of turning ideas and imagination into devices and systems.
6) Some technological problems are best solved through experimentation.
7) Fluid power systems are categorized as either pneumatic, which uses gas, or hydraulic, which uses liquids. (FT Version)
8) Automated systems can be powered by alternative energy sources like solar and fuel cells. (FT Version)

Knowledge and Skills
It is expected that students will:

- Know the seven technological resources and how they are integrated into an open and closed loop system.
- Describe the purpose of pseudocode and comments within a computer program.
- Know how to use ratio reasoning to solve mechanical advantage problems.
- Design, build, wire, and program both open and closed loop systems.
- Use motors and sensors appropriately to solve robotic problems.
- Troubleshoot a malfunctioning system using a methodical approach.
- Experience fluid power by creating and troubleshooting a pneumatic device. (FT Version)
- Design, build, wire and program a system operated by alternative energy. (FT Version)
- Explain the roles and responsibilities of mechanical, electrical, and computer engineers who solve robotic problems.